

THE HEREDITY OF ACQUIRED CHARACTERISTICS.

FOR twelve years a titanic contention has been developing in the scientific world, especially among Anglo-Saxons, between two giants of science, Spencer and Darwin, as to whether or not acquired traits may be transmitted hereditarily. This question is of immense importance, not only in explaining the origin of the zoölogical modifications in different species, but also in aiding us to decide whether we can profit organically, so to speak, by the actions of our fathers, *i. e.*, whether the labor of the past can be accumulated and transformed into labor that may be called organic, or whether such labor must be wholly lost.

Especially during the last five years, every new publication referring to this subject has given even stronger evidence of the heredity of acquired traits, thus tending to support Spencer against Weissmann. I have gone a step further in an article written for the "Contemporary Review," in which I show that even our gestures are inherited from ancestors of thousands of years ago. It suffices to mention the attitude of prayer, by which the conquered—stretching out their hands and bending their knees, to show that they were unarmed and ready to allow themselves to be bound—endeavored to disarm the ferocity of the conqueror. Now this gesture, which we see repeated so many times in the Egyptian and Chaldean sculptures, I myself have seen reproduced instinctively by one of my own children not yet two years old, who, when a terrible sickness hindered him from speaking, invoked our pity by a gesture never learned.

Much easier to find, and greater in number, are facts proving that physical characteristics artificially acquired have been hereditarily transmitted. Quite recently, the eminent naturalist, Giacoma Cattaneo, in his work, "*I fattori dell' evoluzione biologica*" (Genoa, 1897), gave, as an illustration, the sea-lobster, which, possessing the habit of inserting the abdomen into the shells of other mollusks, has the abdomen and the hind parts of the cephalothorax decalcified and membranous, the last two pairs of thoracic claws shortened, and the penultimate pair of abdominal pseudo-claws transformed into a hook. The latter fixes the

animal to its dwelling, so that the abdomen can roll itself to the right or to the left, according to the direction of the turns in the shell it occupies. The fact that the larvæ present these characteristics before occupying the shell gives us an example of an individual moulding itself after the form of an outside body destined for its dwelling.

I have found in my study of camels, however, an example perhaps still more curious and significant. It is known that, with the exception of its stature, the camel is absolutely a llama; its blood globules being elliptical, its teeth reptilian in form, its rudimentary third and fifth toes permanent. It possesses, further, that mysterious pouch of the stomach for the storage of fluids, the same kind of callosity on breast-bone and knees, acquired by the camel through kneeling to receive loads. But the camel differs strikingly from the llama in that it possesses the hump,—that fatty mass, with a special development of some of the spinal processes. For a long time, I could not explain this hump. One day, however, a poor porter, having a complaint in his chest, came to consult me; and, on examination, I found, half-way down his back, precisely where he was wont to rest his burdens, a tumor larger than a man's fist, formed almost wholly of adipose tissue. It suddenly occurred to me that this lump—which not only caused the porter no inconvenience, but even aided him in his work—might perhaps serve as a clue to my mystery of the camel's hump. However, in science more than elsewhere, the proverb, "One swallow does not make a summer," holds good. I recognized at once the necessity of examining many other porters; but as few of the healthy ones would allow themselves to be stripped—even for pay—this was not an easy task. Modest sensitiveness, which to science is as smoke in the eyes, hindered my investigations. Nevertheless, with the aid of my colleagues, I succeeded in examining seventy porters of various occupations, and I was able to find four more examples of this fatty tumor.¹

What was of even greater value in our inquiry was the fact that 50 per cent of the porters examined, although having no real hump, yet presented an unusual protuberance of the spinal processes; and all around this there was a thickening and clogging of the subcutaneous tissue, so as to form a true boss, but without a definite contour. To this the porters have given the special name, "tuaz," the etymological origin of which word my good friends Flechia and Teza, masters of philology, will never be able to tell me.²

¹ "Sur le lipome des portefaix et la bosse de chameaux."—"Bulletin de la Société d'Anthropologie de Bruxelles," ii., fas. 4.

² *Ibid.*

Two veterans of the art presented formations still more singular, namely, curvatures of the spine, or true acquired humps; while the breast was puffed up.

Now one who would trust to hypotheses, contenting himself with few facts, might think that he had solved the problem; for if the backs of our workmen are changed by a few years of burden-carrying, how much more natural that, after uncountable ages of burden-carrying, a modification of the backs of camels should result. For in the case of the camel, the effects of heredity and selection must be added to the mechanical effect of carrying, because the masters of the steppes and of the desert must have found the animal with, so to speak, an anatomical saddle, more serviceable than the llama, with his slippery back. To corroborate these researches, we may add the discoveries of Cope,¹ of Baudry, and especially of Lombardini,² who became the greatest of the European students of the camel, which prove that this animal, by its anatomical characteristics, is among the most ancient,—so ancient, in fact, that in geological time it almost approaches the fossils. In the historic world, however, it appears only as a domestic animal, and in great numbers. Darwin showed that these conditions rendered the transformations in individuals and species more easy; particularly in the warm regions of India and Africa, where other animals, such as the ox and the zebu, present, under pressure of the yoke, fatty accretions. And as the camel has no near relatives among wild animals,—or at least very uncertain ones,—its fossil ancestors were much more plentiful in those regions of America where not only the llama, but, what is of more consequence, its wild kinsman, the guanaco, exists, through which we are enabled to follow out its whole descent.

Further, this hump—which really, as in the tumors of the porters, is only a collection of fat around a slight protuberance of the vertebral processes—is atrophied in the racing camel, *Mahhari*, as well as in the camel when in a wild state, that is, when it has reverted to that condition. On the other hand, it is found well formed in the new-born creature; and in the little camel, a month old, who has never borne a burden, the hump is as great, proportionately, as in the adult. The same is true of those callosities of the knees and breasts, which arise in the camel from continual kneeling to receive its load, and are acquired like callosities on the human body. These callosities are wanting in the camel's wild brethren, but are perfectly apparent in the young

¹ "The Phylogeny of the Camel." Philadelphia, 1875.

² "Dei Cammelli." Pisa, 1879.

camel before he has begun to work.¹ I may add that these callosities are found in the American llama, while they are missing in the guanaco, which is a wild llama.

What I have stated is confirmed by a study of the dromedary, which is a camel with one hump. Lombardini has discovered, in fact, that the single hump of the dromedary is nothing but a fusion of the double hump. As the distribution of loads, under the primitive method of saddling, had produced on that llama which became the camel the double collection of fat,—owing to the double point of resistance,—so, later, when the Turcomans changed the form of the trapping, the second hump began to disappear. The latter process was aided by art; for the Turcomans were accustomed to amputate one of the humps of the newborn camel, for better convenience of storage; and they preferred to breed from those animals having the second hump less developed. Consequently, this anomaly, created by man, became modified by man; and thereby double, or rather new, proof is presented of the heredity of acquired characteristics. That thousands of years were needed to accomplish this end is shown by the fact that in very ancient monuments the camel is represented with two humps, perfectly formed.

It appears that the camel entirely without a hump has existed only in the forms of llama, alpaca, and guanaco, which would support the theory that a large percentage of our domestic animals originated in America, and lived there in a wild state, as did the horse, in exceedingly remote times. Even the Arabic name of the camel, "Hamal," which means to bear, indicates that prehistoric man knew it only as a beast of burden.

But the tumor of the camel has enabled me to explain to my own satisfaction the genesis of another acquired characteristic which has become hereditary in the human race. It is that sort of adipose appendage attached to the buttocks and the flanks of our Hottentot sisters, on which their infants are supported while they themselves are busied in work. Here a demonstration is afforded similar to that concerning the adipose tumors of the porters; the researches of Blainville having proved that this tumor of the Hottentots consists simply of fat, with a little connective tissue. That this also is a very ancient development, is shown by the fact that the Pyramids of King Thothmes II present us with a picture of the tributaries of that Pharaoh, in which the women display this appendage in very characteristic form. Further evidence on this point is furnished by the discoveries of Fritsch, which

¹ V. CATTANEO: "La Gobba e la Callosità dei Cammelli." Milan, 1896.

show that in the Hottentots, as in many other equatorial peoples, adipose tissue abounds everywhere in the body, even producing wrinkles in the young; and it is natural that it should become increased in quantity, forming a new organ where the pressure and irritation are greatest.¹ Finally, the Hottentot, a residuum of the dwarf races that once populated the globe and now have disappeared, is, like the camel, one of those almost fossil races,—a fact made manifest by his general structure, his dwarfishness, and his tufted hair. His age-long existence has afforded opportunity for the production of profound modifications.

Thus far I have spoken only of physical characteristics; but in the Hebrews the psychical as well as the physical have been transmitted and modified. From the study of very ancient Hebrew skulls, and from the representation of the Hebrew scribe in the Egyptian Pyramids, it appears certain that many of the physical characteristics of the modern Hebrew have been inherited from thousands of years ago; as, for example, the dolichocephalism, prognathism, thickness of eyebrow, and fulness of lips. In regard to the psychical characteristics, we find: tenacity of purpose, even to the point of obstinacy, religious credulity, clannishness, intolerance, a spirit of rebellion carried often as far as anarchy. These traits have led to the greatest religious and social rebellions. Next, we have the ethical passion; almost all apostles of moral reform having risen from the Hebrews. Certainly Semitic, if not strictly Hebrew, was the commercial instinct that led the Phœnicians to invent the use of money and weights; that made of the Sidonians the greatest manufacturers of stuffs and of glass; and of the Hebrews, even under the Assyrians, the greatest financiers of the Assyrian world. In the time of Alexander the Hebrews were the most powerful merchants of Babylon, of Antioch, and of Crete, in which latter island the merchants were wont to conceal their treasures in troublous times.² But from climatic causes, and through race minglings,—which certainly have been frequent,—many of the physical characteristics have disappeared, the Hebrews in England having fine and blond skins, and those of Italy, rounded or squarish skulls.

I repeat that many of the psychical characteristics of the Hebrews have become completely changed, so that now they are like those of their fellow-citizens. While originally they had a true

¹ For further data, *vide* LOMBROSO: "Donna delinquente," 1890; BLANCHARD: "La Steatopigie des Ottentottes," 1879.

² EWALD: "Die Alterthümer der Völker Israel," 1895.

hatred of the plastic arts, they now have painters and sculptors: we find among them spendthrifts and sceptics. The greatest opposers of the religious idea, Acosta and Spinoza, were born Hebrews. Finally, they now have characteristics which they not only lacked at first, but which they could not have acquired without an admixture of other blood. Courage and contempt of life were among the salient characteristics of the race that poured torrents of its own blood in defence of the walls of Massada, which stronghold the conqueror, on his entrance, found empty. Such a spectacle was new, even to a Roman.

The Abyssinian is the true heir and the nearest relation of the Hebrew; having emigrated in ancient times from Judea in several expeditions. The latter began, under Solomon, with an expedition of 120,000 men,—warriors and priests,—who established a son of Solomon upon the throne. Then followed, in the times of Nebuchadnezzar and Shalmaneser, a second and a third emigration. Finally, in the time of Titus, a fourth took place, which established itself in the Valley of Samen, where the artisan's craft was exercised. These pure Hebrews formed that military aristocracy which governed feudally the people called, with contempt, "mixed" or Abyssinians. This people became converted to Christianity; but they preserved from their Hebrew origin, besides the peculiarities of face and skull, many of the customs, *e. g.*, paschal rites, offering of food in the temple; the use of musical instruments,—the cithern for example,—the custom of religious dances, fasts, aversion to swine, and dislike of weapons. Until a few years ago, they employed the Davidean sling. The Abyssinians manifest not only a cohesion very rare in the African world, but such courage and extraordinary warlike ability that they have discomfited the best-armed civilized nations. Courage and the art of war were psychical characteristics hereditary within them. The age-long humiliation, begun at the time of the Roman conquest, so crushed the Hebrews, as to leave surviving only the timid and those who, showing less boldness, were able to avoid or forestall oppression. The result is that, instead of warlike and heroic courage, we find among characteristics of the Hebrews timidity and love of gain. This may be established statistically by the very small number of suicides, and of soldiers.

While Jacobs² finds in Europe almost twice as many Hebrew as

¹ JOSEPHUS, vol. II.

² J. JACOBS: "Comparative Distribution of Ability among the Hebrews," in the "Journal of Anthropol. Institute of Great Britain and Ireland," London, 1885-86, pp. 251-79, table XV.

Christian lawyers and physicians, ten times as many philologists and metaphysicians, seven times as many musicians, almost twice as many poets of talent, yet, among soldiers, the proportion of Hebrews is reduced almost to nothing—six against fifty-six.

As to suicides, according to Legoit, among Germans and Austrians there are 102 suicides per million among Protestants; 62 per million among Catholics; and 48 per million among Hebrews.¹ Yet the Hebrews furnish four or five times as many mad persons as their Catholic fellow-citizens; and it is known that the greater proportion of suicides are mad. Avidity of gain is a characteristic that has now become almost hereditary among the Hebrews, though not among the Abyssinians. Again, we find among the Hebrews an excessive activity and curiosity, political and scientific; while inertia, apathy, and the absence of scientific curiosity, are proverbial in the Semite. For him, "God is great!" is the whole explanation of the universe; and science concludes with lyric poetry and proverbs.² The Arabs let the best hydraulic constructions of the Romans go to ruin; and the Semite in time of scarcity will die of hunger rather than increase the amount of his labor. This excessive apathy and the ignorance resulting therefrom, disappeared in the Hebrew, giving place, as I have stated, to an unbounded curiosity and a feverish activity in all branches of human endeavor,—even in those sciences, like mathematics, to which his talent always shows itself to be unadapted,³—making the Hebrew the born reporter and journalist of the modern world.

Here we have, then, a series of acquired psychical characteristics which have become hereditary. This, no doubt, is due to some extent to climatic influences,—transportation to colder countries;—but more particularly to selection by persecution, as only by activity and an appearance of meanness and sordidness could the Hebrews have been saved from the fierce persecutions against which bold resistance would have been of no avail. It was this fact that made those vices prevail, and that caused the extinction, little by little, of those qualities—courage, generosity, and boldness—that would have been more harmful than useful under the particular conditions.

These, combined with climatic influences and other peculiar circumstances effective in rendering new qualities in the Hebrews hereditary, make it easy for us to see why in some regions, especially in

¹MORSELLI, "Suicidi," 1876, corroborates these figures.

²RENAN: "Histoire des Langues sémitiques."

³HERSCHEL, BEER, SYLVESTER, GOLDSCHMIDT, etc.

warm countries and those where there was no persecution, they have not progressed a step beyond their fellow-countrymen. Thus in Abyssinia, they have excelled in nothing, although—perhaps because—they have suffered no persecutions in that country. They have deteriorated also in their native land of Judea, although there they have been the objects of peculiar care from their devout coreligionists of all Europe.

Moreover, does not the North American offer the best evidence of the heredity of newly acquired characteristics, both physical and psychical? The skin has become darker, the orbits larger, the neck longer, the head smaller and more rounded, the fingers longer than those of his Anglo-Saxon father. And as to his moral nature, it is well known how much he has changed from the British type. The overwhelming reverence of the English for tradition and historic formalism has been replaced by a true passion for modernity. For in America, the machine writes for you, sews, cooks, records, and calculates for you; venerable statutes are partly superseded by lynch law, and Anglican orthodoxy gives place to the most whimsical heterodoxies. How does this happen? It happens because a race among the most robust of Europe has been transported to different surroundings; and the struggle for existence—rendered fiercer in the wilderness and among hostile tribes,—if it served to destroy the weaker, gave room for the greater development of the strong, in whom qualities, perhaps already existent in the pacific Briton, but not yet unfolded for lack of occasion, emerged in the new adaptations required for new adventures. But, above all, the American has broken completely all the constraints and bonds of historical traditions that have remained so tenacious in Europe: he has, on the contrary, developed the sense of the new, and of independence, in opposition to the respect for what is old and for the customs and tradition, which, for opposite reasons, has remained instinctive in the nations of the old continent. The English habits vanished; and the great struggles against Nature, as well as the use of machinery and of the printing-press, gave to the Yankee the same power which enabled the first white man to subjugate the dog and the horse. While these conditions detached him—perhaps fortunately—from every æsthetic sense, they developed, even to the point of a natural disposition, the sense of the grandiose and the gigantic, which he carries into his buildings, his monuments, and his undertakings generally.

But, after all, a single proof will suffice to show the acquirement of psychical characteristics: Civilized man has acquired in the cerebral

cortex,—in a fold of the parietal lobe,—the psychical centre of reading, which in certain maladies, especially in apoplexy, is paralyzed, causing the reading power to disappear. Now this centre has positively been acquired within historic time, although the period cannot be definitely fixed; it certainly is not found in men yet savage. The same may be said of the speech-centre,—the third left frontal convolution,—since everything goes to prove that the first man had no language, just as the new-born child has no language, and the Hottentots and the Weddahs have but very imperfect ones. This organ continues to become more and more differentiated in our modern civilization. Where can be found a stronger evidence that there are acquired psychical characteristics?

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